

## The Mating and Predatory Behavior of *Mellinus rufinodus* Cresson (Hymenoptera: Sphecidae)

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*Abstract.* — Males of *Mellinus rufinodus* Cresson establish and defend territories on dung and mate frequently with females arriving at the dung. Females capture various small flies that visit the dung, either consuming them directly or carrying them to the nest in flight.

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Little is known concerning the behavior of any of the four species of *Mellinus* occurring in America north of Mexico. The only report is a note by O'Brien (1983), who observed a female *M. bimaculatus* Packard carrying a fly of the genus *Pegomyia* (Anthomyiidae) in its mandibles. In contrast, the Eurasian species *M. arvensis* (Linnaeus) has been studied extensively. Hamm and Richards (1930) reviewed much of the literature prior to that date, and there have been significant contributions since that time by Olberg (1959), Huber (1961), and others. This species nests gregariously in sandy soil and makes a multicellular nest that is provisioned with flies, chiefly Muscoidea. Flies are often captured on dung and are carried to the nest in flight, the wasp holding the mouthparts of the fly in her mandibles. The larva of *M. arvensis* has been described by Maneval (1939) and by Evans (1959). Details of behavior and of larval structure are of particular interest, since there has been some disagreement as to where the genus *Mellinus* properly fits in the classification of the sphecoid wasps (Bohart and Menke, 1976).

The present studies were conducted near my home, 23 km west of Livermore, Larimer Co., Colorado, at an altitude of 2300 m. This is an area of open ponderosa pine-Douglas fir woodland where this species is common in late summer (August and early September). The wasps are not commonly found on flowers, but both sexes visit *Helianthus* and *Cirsium* for honeydew.

### MATING BEHAVIOR

Both males and females are attracted to mammalian feces, where mating occurs. This was first noted 28 August 1987, when several mating pairs were seen on excrement along a trail. Observations were made intermittently at this site until 6 September, after which no wasps remained. In 1988 dung pads were placed in the same area on 26 August, where they quickly attracted wasps and continued to do so until 5 September. Although there is little sexual dimorphism in this species, males could be recognized by their more slender abdomens and, with experience, by their behavior. Wasps were not easily disturbed, and it proved possible to observe within 20 cm of the wasps without altering their behavior.

This made it possible to use a magnifying glass to study details of mating and of prey capture in these small wasps.

Each dung pad is commonly occupied by a male, who remains on or near the dung for most of the day, sometimes as late as 1900 hr, shortly before sunset. Males remain motionless with their antennae extended rigidly forward and slightly upward, or they may walk about with the antennae in motion. Frequently they rotate to face insects that approach. From time to time (though not consistently) they dart at flies, up to 10 cm away, that have landed on or near the dung. Occasionally they strike at ants that cross the dung, but more often ants elicit no response. If a second male arrives, the pair grapple and one of them departs immediately.

On 30 August I marked a male that had been present on a dung pad for some time with a yellow spot on the thorax (Y). A second male (marked white, W) appeared and the two grappled briefly; W left but remained 30–40 cm away for some time. On the following day I placed a second dung pad 1.5 m away. For a time, Y occupied one pad and W the other, but at 1140 hr Y flew to the second pad and displaced W after a brief struggle. For several hours thereafter Y moved back and forth between the two pads, remaining for from 3 sec to 3 min before moving to the other. In one 20-min period, Y moved between the two 14 times. Late in the afternoon Y had been replaced by another male (marked orange, O), although both W and Y remained perched 20–50 cm away.

On the following day, a third dung pad was put in place 1 m from the second. O was territorial all day, moving between two of the dung pads frequently. W and Y remained in the area and from time to time occupied one of the dung pads. On the next day, O moved between the three pads from 0930 to 1554 hr while W remained nearby. Much the same occurred the following day (3 Sept.). Thus, O remained territorial for 4 days, while W was present for 5 days though apparently subordinate to both O and Y. However, W copulated several times, either by intercepting females away from the dung or by occupying dung pads for short periods. There was no obvious difference in the size of these males.

Both Y and O were seen to copulate many times; in one 30-min period, Y was seen to mate 11 times. Since the females were not marked, it is impossible to say how many times each female mated, but it is probable that each mated several times per day (on no occasion did more than 2 females appear at the dung at one time). Females flew into the area, landed 20–50 cm from the dung, and walked to the pad. If a male was present, he without preliminaries leaped onto the female as she approached the dung pad. The male assumed a dorsal position, grasping the female just behind her head with his mandibles and holding her body with all three pairs of legs. The two remained in this position for a few seconds up to 4 min. The male remained motionless, with his antennae thrust rigidly forward, while the female often walked about, her antennae moving up and down rapidly, alternately. When genitalic contact was made, the male released his grasp with his mandibles and legs and assumed a semierect posture. Copulation lasted 2–5 sec. Sometimes the pair then separated, but at other times they remained together for additional copulations. On one occasion a male was seen mating with a female carrying a fly; when they separated the female flew off with the prey. On most other occasions the female left the area without prey after mating, while the male returned to his territorial perch.

## PREDATORY BEHAVIOR

I observed females capturing flies on or near dung pads on several occasions, but usually when no male was present on that pad. Females always approached the dung on foot, then walked slowly to within 1–2 cm of a fly and pounced, seizing and stinging the fly very quickly. In two instances females were seen to devour the flies directly, discarding the remains. On six occasions, females manipulated the flies so as to seize them by their mouthparts, then flew off 1–2 m high. Attempts to follow females to the nests failed, and the nest of this species remains undiscovered.

The flies taken as prey are those commonly attracted to fecal material. However, there was no response to very small flies, such as Sepsidae, or to large Calliphoridae such as *Calliphora livida* Hall. The latter species is considerably bulkier than a female *Mellinus*, measuring 32 mm<sup>2</sup> as compared to 24 mm<sup>2</sup> for *Mellinus* (thorax width times body length). On two occasions *Mellinus* females attacked but failed to capture *Phormia regina* (Meigen) (Calliphoridae) (27 mm<sup>2</sup>) but did succeed in taking one *Orthellia caesarion* (Meigen) (Muscidae) (15 mm<sup>2</sup>). Smaller Sarcophagidae (10–14 mm<sup>2</sup>) of the genus *Ravinia* were most commonly taken, including *R. planifrons* (Aldrich) (2), *R. lherminieri* (Robineau-Desvoidy) (1), *R. pusiola* (Wulp) (1), and one undetermined.

## DISCUSSION

The mating system of *Mellinus rufinodus* provides an example of resource defense polygyny as defined by Thornhill and Alcock (1983). The frequency of mating stands in sharp contrast to that observed in most sphecid wasps, where in the course of several days only a very few matings may be seen, even at male territories. It is likely that in most Sphecidae females mate only once or a very few times (Evans and O'Neill, 1988). The advantages of multiple copulations in *Mellinus* are not obvious. In fact, it appears that females are often prevented from taking prey when a male is present. Also, males often drive flies from the dung, although they are not persistent in this behavior. In most cases of multiple mating in Sphecidae, the males provide some benefit, such as nest guarding (Evans and O'Neill, 1988). Conceivably the males of *Mellinus* prevent flies from ovipositing and thus insure stability of the dung, but this requires examination.

Males of species of *Mellinus* have not previously been reported to be territorial, but the details of actual copulation in *rufinodus* do not differ notably from those of *arvensis* as described by Huber (1961). Predatory behavior in the two species is also similar; females of *arvensis* are said to stalk flies "just as a cat does . . . a sparrow" (Hamm and Richards, 1930). It seems unlikely, however, that *rufinodus* nests gregariously in sandy situations, like *arvensis*, as repeated searches in soil of this type have failed to reveal any nests. Like *bimaculatus*, *rufinodus* is primarily characteristic of open woodlands, and may nest in quite a different substrate.

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